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DATE: March 9, 1999

SUBJECT: TRANSFER FACTOR FOR STRAWBERRY HARVESTERS

Submitted for documentation is a three-page summary entitled *Average Dermal Transfer Factor (TF) for Strawberry Harvesters*, which I prepared on May 7, 1997. As you may recall, this summary was part of the work that I did for estimating the annual average daily dose and lifetime average daily dose for strawberry harvesters exposed to captan. The summary for calculating the captan doses will be documented at a later time.

Attachments: The Summary

Average Dermal Transfer Factor (TF) for Strawberry Harvesters
(intended for internal use only)

Worker Health and Safety Branch
May 7, 1997

The dermal transfer factor (TF) used in this Branch for strawberry harvesters was 3,000 μg/hr dermal residues per $\mu g/cm^2$ foliar residues (based on a two-sided foliage surface). It was an overall arithmetic mean of the (average) TF observed in several studies that are available either in the literature or as registration documents filed with the Department. These TF were calculated for strawberry harvesters not wearing gloves, nor a long-sleeved shirt.

1. *Maddy et al. (1989); handwashes.*

   (6.1 mg/hr) ÷ (2.4 $\mu g/cm^2$) = **2,600** (from data on day 3 for 7 hrs)

2. *The Abamectin Study (Merick & Company, 1993); handwashes.*

   (905 ηg/hr) ÷ (0.37 $\eta g/cm^2$) = **2,500** (after adjustment for a two-sided foliage surface)

3. *The Salinas Captan Study (ICI Americas, 1988); handwashes.*

   (18.9 mg/hr) ÷ (8.1 $\mu g/cm^2$) = **2,300** (using measured foliar residues)

   Measured foliar residues were used to give some consideration for clothing protection from Tee-shirt (but not coveralls as worn by workers in the study), although foliar residues calculated from the log-linear regression for dissipation was preferred and would give a slightly higher TF (2,600).

4. *The Vinclozolin Study (BASF, 1993; Doc. No. 380-112); handwashes.*

   The estimate from this study was around 400 - 1,000; however, there appeared to be some problems with the exposure and residue data. First, the study apparently included a group of well-trained harvesters whose exposures were found to be very consistent compared to those in the first three studies or in those by Popendorf *et al.* (1982). Second, the vinclozolin foliar dislodgeables in this study had rather bizarre behavior in that there appeared to be no dissipation between the first and the second application, and day 2 from the last (6th) application had higher residues than day 0 or day 1. The average (**700**) of the two extremes was considered here in calculating the overall arithmetic mean.

5. *Worker Health and Safety Branch (Saiz, 1990); Tee-shirt only.*

   The grand arithmetic mean of the TF calculated by this Branch was around 880; the dermal exposures used to derive these TF were based on the use of Tee-shirts as the dosimeter, although harvesters wore latex gloves when picking strawberries. The TF extrapolated from this grand mean to whole body was **3,000** following the general observation that exposure from the hands, forearms, and lower body together would account for about 70% of the total dermal exposure.

6. *Popendorf et al. (1982); light-weight cotton gloves.*

    The estimates from studies/trials by these investigators, including the studies by Zweig *et al*. (1983; 1994), were 6,000 to 10,000 for a TF based on a two-sided foliage surface. Such high estimates are expected since inexperienced workers and cotton gloves were used.

    For calculating the overall arithmetic mean, a *single* value of **8,000** was used to represent the several TF derived from these studies. The reason for treating all TF from these studies as one study is as follows: Many of these TF were based on exposures from inexperienced youths (and family adults). Besides the use of light-weight cotton gloves (in lieu of handwashes), which might have inflated the hand exposure somewhat, a lifetime exposure of 40 years was considered here. More bluntly, after a few years in the business, inexperienced workers would become experienced harvesters whose exposure from picking strawberries is expected to be substantially lower.

7. *Winterlin et al. (1984); latex gloves.*

    The estimate for average dermal exposure derived from this study, and hence for transfer factor as well, was very low, especially when compared to those from the studies by Zweig *et al*. or by Popendorf *et al*. The TF estimate calculated from this study was around **1,000**, to some extent depending on what the clothing protection factor or the surface area is for each of the body regions monitored. In this study, thigh and shin exposures together amounted to more than half of the total body exposure. As pointed out by Zweig *et al*. (1984), who also explicitly stated that the foliar residue concentrations in their own study(ies) were expressed as from a single-sided leaf disc surface, one possible reason for the huge discrepancy in their observations on dermal exposure is that they used light cotton gloves as hand dosimeters, while Winterlin *et al*. used latex gloves. Gloves of the former type tend to overestimate hand exposure, whereas those of the latter tend to underestimate hand exposure, when compared to handwashes.

Overall.

$2,600 + 2,500 + 2,300 + 700 + 3,000 + 8,000 + 1,000 = 2,871 \approx$ **3,000**.

References

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